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09/992,462

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Chris W. Hill

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09/02/2004

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EXAMINER

SOWARD, IDA M

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 09/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/992,462

Applicant(s)

HILL, CHRIS W.

Examiner

Ida M Soward

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Applicant's amendment filed June 16, 2004.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2, 5 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) in view of Shufflebotham et al. (US 6,184,158 B1).

Ravi teaches a method of forming a dielectric layer in an opening, comprising: forming a first dielectric layer 62 in the opening G, the opening having an aspect ratio greater than about two, and wherein a portion of the opening not filled with said first dielectric layer has an aspect ratio of not greater than about two; and forming a second dielectric layer 64 over the first dielectric layer, the second layer filling the portion of the opening not filled with the first dielectric layer and having a top surface that is not within the opening such that voids are substantially not present in the opening. In regard to claims 2 and 5, Ravi further teaches providing a substrate before forming the opening; and forming a first dielectric layer includes forming the first dielectric layer having a top surface that is within the opening. In regard to claim 14, Ravi teaches providing a

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substrate; forming an opening relative to the substrate, the opening having an aspect ratio greater than about 2; forming a first dielectric layer in the opening, wherein a portion of the opening not filled with said first dielectric layer has an aspect ratio of not greater than about two; and forming a second dielectric layer over the first dielectric layer; the second layer filling the portion of the opening not filled with the first dielectric layer and having a top surface that is not within the opening such that voids are substantially not present in the opening. In regard to claim 15, Ravi teaches forming an opening includes forming an opening in the substrate (Figure 3, cols. 8-9, lines 57-61 and 1-59, respectively).

However, Ravi fails to teach a second dielectric layer at a second deposition rate greater than the first deposition rate. Shufflebotham et al. teach a second dielectric layer at a second deposition rate greater than the first deposition rate (col. 2, lines 46-61).

Since Ravi and Shufflebotham et al. are from the same field of endeavor (method of forming dielectric layers), the purpose disclosed by Shufflebotham et al. would have been recognized in the pertinent art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi with the method of forming a dielectric layers having a second dielectric layer at a second deposition rate greater than the first deposition rate as taught by Shufflebotham et al. to produce high quality dielectric films (col. 2, lines 30-34).

Claims 3, 7-8, 16-19 and 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) and Shufflebotham et al. (US 6,184,158 B1) as applied to claims 1-2, 5 and 14-15 above, and further in view of Kocmanek et al. (5,252,520).

Ravi and Shufflebotham et al. teaches all mentioned in the rejection above. However, Ravi and Shufflebotham et al. fails to teach and first dielectric layer having a first process setting, at least one of the first and second layer the opening such that voids are substantially not present in the opening; the second and final dielectric layer having a second process setting at a predetermined relationship with the first process setting; forming an opening including forming an opening on the substrate; forming a plurality of structures on the substrate so that the plurality of structures forms an opening; forming a plurality of structures including forming a plurality of conductors. Kocmanek et al. teach a method of forming a dielectric layer during the manufacture of a semiconductor device, comprising: first dielectric layer having a first process setting, at least one of the first and second layer the opening such that voids are substantially not present in the opening; and the second and final dielectric layer having a second process setting at a predetermined relationship with the first process setting (col. 2, lines 1-22); forming an opening including forming an opening on the substrate; forming a plurality of structures on the substrate so that the plurality of structures forms an opening; forming a plurality of structures including forming a plurality of conductors 15 (Figure 1, cols. 1-2, lines 63-68 and 1-41, respectively). In regard to claims 8 and 20-25, Kocmanek et al. further teach dielectric layer 17 and 21 grown by different CVD

process settings. Therefore, it is within the level of ordinary skill to form the first and second dielectric layers at first and second temperatures, pressures, dopant concentrations, dopant flow rates and shower head distances because the first 17 and second 21 dielectric layers growth process settings are different (Figure 1, col. 2, lines 2-68). Since Ravi and Kocmanek et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Kocmanek et al. would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening of Ravi and the method of forming a dielectric layers having a second dielectric layer at a second deposition rate greater than the first deposition rate as taught by Shufflebotham et al. with process settings and plurality of structures as taught by Kocmanek et al. to eliminate the problem of chemical attack and water absorption (col. 1, lines 28-46).

Claims 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) and Shufflebotham et al. (US 6,184,158 B1) as applied to claims 1-2, 5 and 14-15 above, and further in view of Chou et al. (5,861,345).

Ravi and Shufflebotham et al. teaches all mentioned in the rejection above. However, Ravi and Shufflebotham et al. fails to teach a first dielectric layer having a top surface that is not within the opening. Chou et al. teach a first dielectric layer 126 having a top surface that is not within the opening 122 (Figure 3C, col. 4, lines 21-67). Since Ravi and Chou et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Chou et al. would have been

pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi and the method of forming a dielectric layers having a second dielectric layer at a second deposition rate greater than the first deposition rate as taught by Shufflebotham et al. with the first dielectric top surface as taught by Chou et al. to eliminate delamination due to poor adhesion (col. 3, lines 27-30).

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) and Shufflebotham et al. (US 6,184,158 B1) as applied to claims 1-2, 5 and 14-15 above, and further in view of Lin (5,969,409).

Ravi and Shufflebotham et al. teaches all mentioned in the rejection above. However, Ravi and Shufflebotham et al. fails to teach forming a dielectric layer completely filling an opening. Lin teaches forming a dielectric layer 3 completely filling an opening 2 (Figures 2-7, cols. 7-8, lines 48-67 and 1-7, respectively). Since Ravi and Lin are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Lin would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi and the method of forming a dielectric layers having a second dielectric layer at a second deposition rate greater than the first deposition rate as taught by Shufflebotham et al. with forming the dielectric layer completely filling an opening of Lin to decrease process complexity (col. 3, lines 22-36).

Claims 6, 9-13 and 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ravi (5,807,785) and Shufflebotham et al. (US 6,184,158 B1) as applied to claims 1-2, 5 and 14-15 above, and further in view of Jang et al. (5,563,104).

Ravi and Shufflebotham et al. teaches all mentioned in the rejection above. However, Ravi and Shufflebotham et al. fails to teach forming first and second dielectric layers through an ozone-TEOS deposition; and first and second process settings selected from a group consisting of temperature, reactor chamber pressure, dopant concentration, flow rate, and shower head spacing. Jang et al. teach forming first **16** and second **18** dielectric layers through an ozone-TEOS deposition. Jang et al. further teach forming the first dielectric layer at a first process setting and forming a second dielectric layer at a second process setting at a predetermined relationship with the first process setting, wherein the first and second process setting consists of first and second temperatures (Figure 2, col. 2, lines 16-52). Also, it is within the level of ordinary skill to form the first and second dielectric layers at first and second temperatures, pressures, dopant concentrations, dopant flow rates and shower head distances because the first **16** and second **18** dielectric layers of Jang et al. are different thickness which requires different process settings. Since Ravi and Jang et al. are from the same field of endeavor (method of forming dielectric layers in openings), the purpose disclosed by Jang et al. would have been pertinent in the art of Ravi. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of forming a dielectric layer in an opening as taught by Ravi and the method of forming a dielectric layers having a second

dielectric layer at a second deposition rate greater than the first deposition rate as taught by Shufflebotham et al. with forming the ozone-TEOS layers of Jang et al. to reduces pattern sensitivity (col. 1, lines 48-51).

Response to Arguments

Applicant's arguments filed 06-16-04 have been fully considered but they are not persuasive. An aspect ratio great than about two and an aspect ratio of not greater than about two falls in the range of an aspect ratio of between 1.5:1 up to approximately 2:1 OR MORE as taught by Ravi in col. 9, lines 55-59).

The other Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respect to the method of forming dielectric layers in an opening:

Cerny et al. (Us 6,667,553 B2)

Yamamoto (US 2002/0158339 A1).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M Soward whose telephone number is 571-272-1845. The examiner can normally be reached on Monday - Thursday, 6:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

IMS
August 27, 2004



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